Title: COVID-19: $R_0$ is lower where outbreak is larger

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Abstract:
We use daily data from Lombardy, the Italian region most affected by the COVID-19 outbreak, to calibrate a SIR model individually on each municipality. These are all covered by the same health system and, in the post-lockdown phase we focus on, all subject to the same social distancing regulations. We find that municipalities with a higher number of cases at the beginning of the period analyzed have a lower rate of diffusion, which cannot be imputed to herd immunity. In particular, there is a robust and strongly significant negative correlation between the estimated basic reproduction number ($R_0$) and the initial outbreak size, in contrast with the role of $R_0$ as a predictor of outbreak size. We explore different possible explanations for this phenomenon and conclude that a higher number of cases causes changes of behavior, such as a more strict adoption of social distancing measures among the population, that reduce the spread. This result calls for a transparent, real-time distribution of detailed epidemiological data, as such data affects the behavior of populations in areas affected by the outbreak.

Data description:
Daily COVID-19 cases recorded at the municipality level in Lombardy (most affected Italian region) between March 25 and April 14.

JEL codes: I12, I18, C53, C22

Keywords: COVID-19, tests, basic reproduction number, social distancing, containment

Link: https://pietrobattiston.it/_media/economics:bg_covid_lombardy.pdf